

Updated Status of Federally Listed ESUs of West Coast Salmon and Steelhead

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B.2.7 CENTRAL CALIFORNIA COAST STEELHEAD

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B.2.7.1 Summary of Previous BRT Conclusions

The Central California Coast ESU was determined to inhabit coastal basins from the Russian River (Sonoma County), to Soquel Creek (Santa Cruz County) inclusive (Busby et al. 1996). Also included in this ESU are populations inhabiting tributaries of San Francisco and San Pablo bays (though there is some uncertainty about the latter). The ESU is composed only of winter-run fish.

Summary of major risks and status indicators

Risks and limiting factors—Two significant habitat blockages reported by Busby et al. (1996) are the Coyote and Warm Springs Dams in the Russian River watershed; data indicated that other smaller fish passage problems were widespread in the geographic range of the ESU. Other impacts noted in the status report were: urbanization and poor land-use practices; catastrophic flooding in 1964 causing habitat degradation; and dewatering due to irrigation and diversion. There has been no formal analysis of the relative strengths of these various impacts. Principal hatchery production in the region comes from the Warm Springs Hatchery on the Russian River, and the Monterey Bay Salmon and Trout Project on a tributary of Scott Creek. At the time of the status review there were other small private programs producing steelhead in the range of the ESU, reported by Bryant (1994) to be using stocks indigenous to the ESU, but not necessarily to the particular basin in which the program was located. There was no information on the actual contribution of hatchery fish to naturally spawning populations.

Status indicators—One estimate of historical (pre-1960s) abundance was reported by Busby et al. (1996): Shapovalov and Taft (1954) described an average of about 500 adults in Waddell Creek (Santa Cruz County) for the 1930s and early 1940s. A bit more recently, Johnson (1964) estimated a run size of 20,000 steelhead in the San Lorenzo River before 1965, and CDFG (1965) estimated an average run size of 94,000 steelhead for the entire ESU, for the period 1959-1963 (see Table B.2.7.5 for a breakdown of numbers by basin). The analysis by CDFG (1965) was compromised by the fact that for many basins, the data did not exist for the full 5-year period of their analysis. The authors of CDFG (1965) state that “estimates given here which are based on little or no data should be used only in outlining the major and critical factors of the resource.”

Recent data for the Russian and San Lorenzo Rivers (CDFG 1994, Reavis 1991, Shuman 1994¹²; see Table B.2.7.5) suggested that these basins had populations smaller than 15% of the size that they had had 30 years previously. These two basins were thought to have originally contained the two largest steelhead populations in the ESU.

¹² The basis for the estimates provided by Shuman (1994) appears to be questionable.

A status review update conducted in 1997 (NMFS 1997) concluded that slight increases in abundance occurred in the 3 years following the status review, but the analyses on which these conclusions were based had various problems, including inability to distinguish hatchery and wild fish, unjustified expansion factors, and variance in sampling efficiency on the San Lorenzo River. Presence/absence data compiled by P. Adams (SWFSC, personal communication) indicated that most (82%) sampled streams (a subset of all historical steelhead streams) had extant populations of juvenile *O. mykiss*.

Table B.2.7.5. Summary of estimated runs sizes for the Central Coast steelhead ESU, reproduced from Busby et al. (1996), Tables 19 & 20.

River Basin	Estimate of Run Size	Year	Reference
Russian River	65,000	1970	CACSS (1988)
	1750 – 7000	1994	McEwan and Jackson (1996), CDFG (1994)
Lagunitas Creek	500		CDFG (1994)
	400 – 500	1990s	McEwan and Jackson (1996)
San Gregorio	1,000	1973	Coots (1973)
Waddell Creek	481	1933–1942	Shapovolov and Taft (1954)
	250	1982	Shuman (1994) ¹³
	150	1994	Shuman (1994) ¹³
Scott Creek	400	1991	Nelson (1994)
	<100	1991	Reavis (1991)
	300	1994	Titus et al. (MS)
San Vicente Creek	150	1982	Shuman (1994) ¹³
	50	1994	Shuman (1994) ¹³
San Lorenzo River	20,000	Pre-1965	Johnson (1964), SWRCB (1982)
	1,614	1977	CDFG (1982)
	>3,000	1978	Ricker and Butler (1979)
	600	1979	CDFG (1982)
	3,000	1982	Shuman (1994) ¹³
	“few”	1991	Reavis (1991)
	<150	1994	Shuman (1994) ¹³
Soquel Creek	500 – 800	1982	Shuman (1994) ¹³
	<100	1991	Reavis (1991)
	50 – 100	1994	Shuman (1994) ¹³
Aptos Creek	200	1982	Shuman (1994) ¹³
	<100	1991	Reavis (1991)
	50 – 75	1994	Shuman (1994) ¹³

¹³ The basis for the estimates provided by Shuman (1994) appears to be questionable.

Previous BRT conclusions

The original BRT concluded that the ESU was in danger of extinction (Busby et al. 1996). Extirpation was considered especially likely in Santa Cruz County and in the tributaries of San Pablo and San Francisco Bays. The BRT suggested that abundance in the Russian River (the largest system inhabited by the ESU) has declined seven-fold since the mid-1960s, but abundance appeared to be stable in smaller systems. Two major sources of uncertainty were: 1) few data on run sizes, which necessitated that the listing be based on indirect evidence, such as habitat degradation; and 2) genetic heritage of populations in tributaries to San Francisco and San Pablo Bays was uncertain, causing the delineation of the geographic boundaries of the ESU to be uncertain. A status review update (NMFS 1997) concluded that conditions had improved slightly, and that the ESU was not presently in danger of extinction, but was likely to become so in the foreseeable future (Minorities supported both more and less extreme views on extinction risk). Uncertainties in the update mainly revolved around sampling efforts that were inadequate for detecting status or trends of populations inhabiting various basins.

Listing status

The status of steelhead was formally assessed in 1996 (Busby et al. 1996). The original status review was updated in 1997 (NMFS 1997), and the Central California Coast ESU was listed as threatened in August 1997.

B.2.7.2 New Data and Updated Analyses

There are two significant sets of new information regarding status: 1) numerous reach-scale estimates of juvenile abundance have been made for populations of the ESU, and 2) harvest regulations have been substantially changed since the last status review. Analyses of this information are described below.

Juvenile data

Data on juvenile abundance have been collected at a number of sites using a variety of methods (Alley and Assoc. 1994, 1995, 1997, 1998, 1999, 2000, 2002a, 2002b; Smith 1992, 1994a, 1994b, 1994c, 1995, 1996a, 1996b, 1996c, 1997, 1998a, 1998b, 1998c, 1999, 2000a, 2000b 2001a, 2001b, 2002). Many of the methods involve the selection of reaches thought to be “typical” or “representative” steelhead habitat. In general, the field crew made electro-fishing counts (usually multiple-pass, depletion estimates) of the young-of-the-year and 1+ age classes. Most of the target reaches got sampled several years in a row; thus there are a large number of short time-series. Although methods were always consistent within a time-series, they were not necessarily consistent across time-series.

Because there are so few adult data on which to base a risk assessment of this ESU, we chose to analyze these juvenile data. However, we note that they have limited usefulness for understanding the status of the adult population, due to non-random sampling of reaches within stream systems; non-random sampling of populations within the ESU; and a general lack of

estimators shown to be robust for estimating fish density within a reach. In addition, even if more rigorous methods had been used, there is no simple relationship between juvenile numbers and adult numbers (Shea and Mangel 2001), the latter being the usual currency for status reviews. Table B.2.6.4 describes the various possible ways that one might translate juvenile trends into inferences about adult trends.

To estimate a trend in the juvenile data, the data within each time-series were log-transformed and then normalized, so that each datum represented a deviation from the mean of that specific time-series. The normalization is intended to prevent spurious trends that could arise from the diverse set of methods used to collect the data. Then, the time-series were grouped into units thought to plausibly represent independent populations; the grouping was based on watershed structure. Finally, within each population a linear regression was done for the mean deviation versus year. The estimator for time-trend within each grouping is the slope of the regression line. The minimum number of observations per time-series is 6 years (Other assessments in this status review place the cut-off at 10 years.). The general lack of data on this ESU prompted us to consider these data despite the brevity of some series.

This procedure resulted in five independent populations for which a trend was estimated (the five sites are the San Lorenzo River, Scott Cr., Waddell Cr., Gazos Cr., and Redwood Cr. [Marin Co.]). Only downward trends were observed in the five populations (Figure B.2.7.4). The mean trend across all populations was significantly less than zero (H_0 : slope ≥ 0 ; $p < 0.022$ via one-tailed t -test against expected value). This suggests an overall decline in juvenile abundance, but it is important to note that such a conclusion requires the assumptions that the assessed populations 1) are indeed independent populations rather than plausibly independent populations, and 2) were randomly sampled from all populations in the ESU (they are probably better regarded as having been haphazardly sampled).

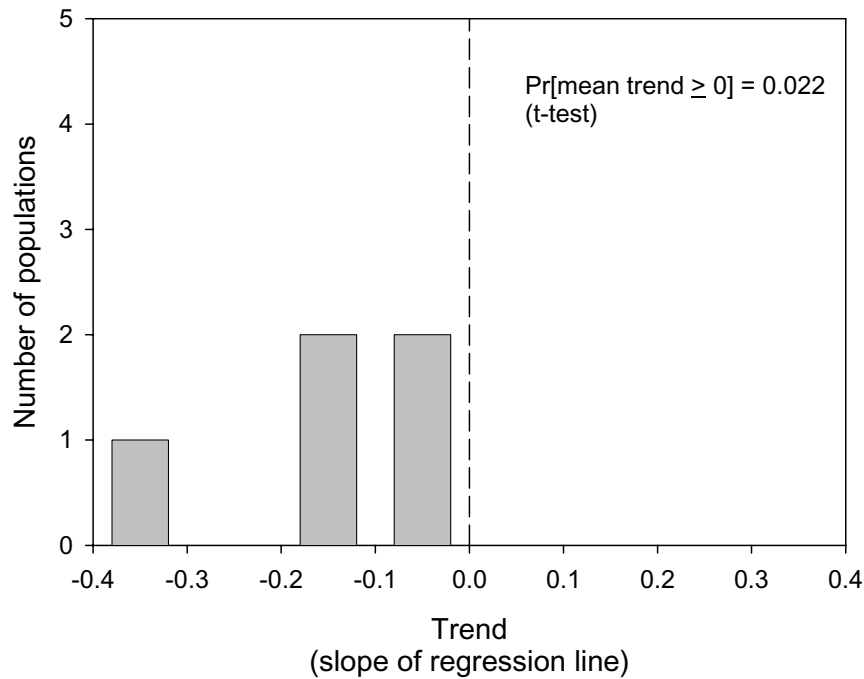


Figure B.2.7.4. Distribution of trends in juvenile densities, for five “independent” populations within the Central Coast steelhead ESU (see text for description of methods). Trend is measured as the slope of a regression line through a time-series; values less than zero indicate decline; values greater than zero indicate increase. Assuming that the populations were randomly drawn from the ESU as a whole, the hypothesis that the ESU is stable or increasing can be statistically rejected ($p = 0.022$); implying an overall decline.

Possible changes in harvest impacts

Since the original status review of Busby et al. (1996), regulations concerning sport fishing have been changed in a way that probably reduces extinction risk for the ESU.

Sport harvest in the ocean is prohibited by the California Department of Fish and Game (CDFG 2002a), and ocean harvest is a rare event (M. Mohr, NMFS, pers. comm.). For freshwaters (CDFG 2002b), all coastal streams are closed to fishing year round except for special listed streams that allow catch-and-release angling or summer trout fishing. Catch-and-release angling with restricted timing (generally, winter season Sundays, Saturdays, Wednesdays, and holidays) is allowed in the lower main stems of many coastal streams south of San Francisco (Aptos Creek, Butano Creek, Pescadero Creek, San Gregorio Creek, San Lorenzo River, Scott Creek, Soquel Creek). Notably, Waddell Creek in Santa Cruz Co. for awhile had a 5-per day bag limit during the winter, for the short reach between Highway 1 and the ocean; this was a mistake as the bag limit was reduced to zero in the supplementary regulations issued in a separate document (CDFG 2002c). Catch and release is allowed year round except April and May in the lower parts of Salmon Creek in Sonoma County and Walker Creek in Marin County. Russian Gulch in Sonoma County has similar regulations except that 1 hatchery fish may be taken in the winter.

The Russian River is the largest system and probably originally supported the largest steelhead population in the ESU. The mainstem is currently open all year and has a bag limit of 2 hatchery steelhead or trout. Above the confluence with the East Branch it is closed year round. Santa Rosa Creek and Laguna Santa Rosa, Sonoma County tributaries to the Russian River, have a summer catch-and-release fishery.

Tributaries to the San Francisco Bay system have less restricted fisheries. All streams in Alameda, Contra Costa, and Santa Clara Counties (east and south Bay) have summer fisheries with bag limit five, except for special cases that are closed all year (Mitchell Creek, Redwood Creek in Alameda Co., San Francisquito Creek and tributaries, and Wildcat Creek). In the north Bay, the lower mainstem of the Napa River has catch-and-release year round except April and May; there is a bag limit of 1 hatchery steelhead or trout. Upper Sonoma Creek and tributaries have a summer fishery with bag limit 5. Summer trout fishing is allowed in some lakes and reservoirs or in tributaries to lakes, generally with 2 or 5 bag limit.

For catch-and-release streams, all wild steelhead must be released unharmed. There are significant restrictions on gear used for angling. The CDFG has prepared a draft Fishery Management and Evaluation Plan (CDFG 2001a) that argues the upper limit of increased mortality due to sport fishing to be about 2.5% in all populations. This estimate is based on an estimated mortality rate of 5% once a fish is hooked, which is consistent with a published meta-analysis of hooking mortality (Schill and Scarpella 1997). Experimental studies on the subject—from which the estimates are made—tend to measure mortality only for a period of a few days or a week after capture (e.g. Titus and Vanicek 1988).

The Fishery Management and Evaluation Plan contains no extensive plans for monitoring fish abundance. Although the closure of many areas, and institution of catch-and-release elsewhere, is expected to reduce extinction risk for the ESU, this risk reduction cannot be

estimated quantitatively from the existing datasets, due to the fact that natural abundance is not being measured.

Resident *O. mykiss* considerations

Resident (non-anadromous) populations of *O. mykiss* were assigned to one of three categories for the purpose of provisionally determining ESU membership (See “Resident Fish” in the introduction for a description of the three categories and default assumptions about ESU membership). The third category consists of resident populations that are separated from anadromous conspecifics by recent human-made barriers such as dams without fish ladders. No default assumption about ESU membership was possible for Category 3 populations, so they are considered case-by-case according to available information.

As of this writing there are few data on occurrence of resident populations and even fewer on genetic relationships. A provisional survey of the occurrence of Category 3 populations in the ESU (see Appendix B.5.2) revealed the following: In the watersheds inhabited by this ESU, at least 26% of stream kilometers lie behind recent barriers, and a number of resident populations are known to occur above the barriers (Appendix B.5.2). One significant set of Category 3 populations is in Alameda Creek, a tributary of San Francisco Bay. Nielson (2003) examined mitochondrial DNA and microsatellite DNA of fish from four subbasins of Alameda Creek and found that three of the subpopulations were most similar to each other and were more similar to populations from other creeks within the ESU (Lagunitas and San Francisquito creeks) than they were to populations outside the ESU. This strongly suggests that these Category 3 subpopulations should be considered part of the ESU. The fourth subpopulation, which occurred in Arroyo Mocho, was quite distinct and was more similar to Whitney hatchery stocks than it was to other subpopulations within the basin or even the wider ESU. Nielson (2003) suggests that this population may either be a population of native rainbow trout with no association to anadromous forms, or has experienced significant genetic introgression from introduced hatchery stocks.

Gall et al. (1990) examined the genetics of two populations in tributaries of the Upper San Leandro Reservoir, on San Leandro Creek. This creek drains into the San Francisco Bay and is, interestingly, the type locality for *Salmo irideus*, now known as *Oncorhynchus mykiss irideus* (Gall et al. 1990, Behnke 1992). Gall et al. (1990) analyzed genetic variability at 17 marker loci using electrophoresis, and concluded that the populations truly belonged to the coastal subspecies of *O. mykiss* (i.e. ssp. *irideus*). However, their study was not designed to assess whether the populations were more similar to hatchery stocks than to nearby wild populations. They reported anecdotal observations that the fish make steelhead-like runs to and from the reservoir.

B.2.7.3 New Hatchery Information

California hatchery stocks being considered for inclusion in this ESU are those from Don Clausen Fish Hatchery and the Monterey Bay Salmon & Trout Project. The stocks and their associated hatcheries were assigned to one of three categories for the purpose of determining ESU membership at some future date (See “Artificial Propagation” in the introduction for a description of the three categories and related issues regarding ESU membership). To make the

assignments, data about broodstock origin, size, management, and genetics were gathered from fisheries biologists and are summarized below.

Don Clausen Fish Hatchery (Warm Springs steelhead [CDFG])

The hatchery and collection site is located on Dry Creek, 14 miles above the confluence of Dry Creek and the Russian River and 47 river miles from the ocean. In 1992, the Coyote Valley Fish Facility was opened at the base of Coyote Valley Dam on the East Fork of the Russian River, 98 miles from the ocean. Both facilities trap fish on site. Coyote Valley fish are trapped and spawned there, but raised at Don Clausen Hatchery. The Coyote Valley steelhead are imprinted for 30 days at the facility before release.

Broodstock origin and history—The hatchery was founded in 1981 and the first steelhead releases were in 1982. The Coyote Valley Fish Facility was opened in 1992. Don Clausen Hatchery has had few out-of-basin transfers into its broodstock. However, significant numbers of Mad River Hatchery steelhead have been released into the basin. In the earlier part of the century, steelhead from Scott Creek were released throughout the basin. Since the Coyote Valley Fish Facility has been constructed, broodstock has been trapped at the facility.

Broodstock size/natural population size—At Don Clausen Hatchery, an average of 3,301 fish were trapped and 244 females were spawned during the broodyears 1992-2002. At the Coyote Valley Fish Facility, there have been an average of 1,947 steelhead trapped from 1993-2002 and an average of 124 females spawned. There are no steelhead abundance estimates for the Russian River, but fish are observed to be widely distributed and plentiful (NMFS, draft HGMP).

Management—As of 1998, steelhead have been 100% ad-clipped. Until broodyear 2000, both hatchery and naturally spawned fish had been included in the broodstock in the proportion that they returned to the hatchery. Since then, only adipose-marked fish are spawned and all unmarked steelhead are relocated into tributaries of Dry Creek. The production goal for Don Clausen Hatchery is 300,000 yearlings released beginning in December by size, with all fish released by April. The Coyote Valley Facility's goal is 200,000 yearlings that volitionally release between January and March.

Category—The hatchery has been determined to belong to Category 2 (SSHAG 2003; Appendix B.5.3). Although some out-of-ESU stocks were present in the basin, there have been no significant introductions since the hatchery began operations. The stock itself has only been cultivated for 20 years. The run is abundant and naturally spawned fish were included in the broodstock until 2000. Since that time only adipose-marked steelhead have been spawned.

Monterey Bay Salmon & Trout Project (Kingfisher Flat [Big Creek] Hatchery; Scott Creek steelhead)

The Kingfisher Flat Hatchery is located on Big Creek, a tributary of Scott Creek 6 km upstream from the mouth. Broodstock are taken by divers netting adults, usually in Big Creek below the hatchery, but at times throughout the Scott Creek system (NMFS, draft Biological Opinion). Steelhead are also taken at a trap on the San Lorenzo River in Felton. San Lorenzo River steelhead are kept separately and released back into the San Lorenzo Basin.

Broodstock origin and history—The Kingfisher Flat Hatchery began in 1975. However, California state hatchery activity near this site has a long history back to 1904 (Strieg 1991). The state hatchery program ended in 1942 due to flood damage. Under the California state hatchery program, Scott Creek steelhead were widely planted throughout coastal California as they were thought to be an exceptionally healthy stock. The hatchery was damaged by floods in 1941-42 and closed. There are limited records of introductions from Mt. Shasta and Prairie Creek hatcheries into this broodstock.

In 1976, the Monterey Bay Salmon & Trout Project began operations at the Big Creek location. Since then, broodstock have been taken either in Scott Creek by divers or at a trap in the San Lorenzo River near Felton. Since that time, there have been no introductions into the broodstock. As with all Co-operative hatcheries, the fish are all marked and hatchery fish are usually excluded from broodstock. Fish are released in either Scott Creek or the San Lorenzo River depending on the source of the broodstock.

Broodstock size/natural population size—An average of 98 fish were trapped and 25 females spawned during the 1990-96 broodyears. There are no abundance estimates for Scott Creek and the San Lorenzo River, but juveniles have been observed anecdotally to be widespread and abundant (NMFS, draft Biological Opinion).

Management—Starting in 2000, the practice of planting San Lorenzo fish into the North Fork of the Pajaro River Basin was discontinued. Although the distance is only a matter of miles, it is across ESU boundaries. The current program goal is the restoration of local steelhead stocks.

Population genetics—Allozyme data groups the Scott Creek, San Lorenzo and Carmel River stocks together (Busby et al. 1996). Collectively they fall within the “south-of-the-Russian-River” grouping.

Category—The hatchery was determined to fall into Category 1 (SSHAG 2003; Appendix B.5.3). The stock has not had out-of-basin introductions in recent years, and hatchery fish are excluded from the broodstock.

B.3 STEELHEAD BRT CONCLUSIONS

The ESA (Sec. 3) allows listing of “species, subspecies, and distinct population segments.” The option to list subspecies is not available for Pacific salmon, since no formally recognized subspecies exist. However, a number of subspecies have been identified for *O. mykiss*, including two that occur in North America and have anadromous populations. According to Behnke (1992), *O. mykiss irideus* (the “coastal” subspecies) includes coastal populations from Alaska to California (including the Sacramento River), while *O. mykiss gairdneri* (the “inland” subspecies) includes populations from the interior Columbia, Snake and Fraser Rivers. Both subspecies thus include populations within the geographic range of this updated status review, but both also include northern populations outside the geographic range considered here. The BRT did not attempt to evaluate extinction risk to *O. mykiss* at the species or subspecies level; instead, we evaluated risk at the distinct population segment (ESU) level, as for the other species considered in this report.

Snake River steelhead ESU

A majority (over 70%) of the BRT votes for this ESU fell in the “likely to become endangered” category, with small minorities falling in the “danger of extinction” and “not likely to become endangered” categories (Table B.3.1). The BRT did not identify any extreme risks for this ESU but found moderate risks in all the VSP categories (mean risk matrix scores ranged from 2.5 for spatial structure to 3.2 for growth rate/productivity) (Table B.3.2). The continuing depressed status of B-run populations was a particular concern. Paucity of information on adult spawning escapements to specific tributary production areas makes a quantitative assessment of viability for this ESU difficult. As indicated in previous status reviews, the BRT remained concerned about the replacement of naturally produced fish by hatchery fish in this ESU; naturally produced fish now make up only a small fraction of the total adult run. Again, lack of key information considerably complicates the risk analysis. Although several large production hatcheries for steelhead occur throughout this ESU, relatively few data exist regarding the numbers and relative distribution of hatchery fish that spawn naturally, or the consequences of such spawnings when they do occur.

On a more positive note, sharp upturns in 2000 and 2001 in adult returns in some populations and evidence for high smolt-adult survival indicate that populations in this ESU are still capable of responding to favorable environmental conditions. In spite of the recent increases, however, abundance in most populations for which there are adequate data are well below interim recovery targets (NMFS 2002).

Based on the provisional framework discussed in the general Introduction to this report, the BRT assumed as a working hypothesis that resident fish below historical barriers are part of this ESU, while those above long-standing natural barriers (e.g., in the Palouse and Malad Rivers) are not. Recent genetic data suggest that native resident *O. mykiss* above Dworshak Dam on the North Fork Clearwater River should be considered part of this ESU, but hatchery rainbow trout that have been introduced to that and other areas would not. The BRT did not attempt to resolve the ESU status of resident fish residing above the Hell’s Canyon Dam complex, as little new information is available relevant to this issue. However, Kostow (2003) suggested that,

based on substantial ecological differences in habitat, the anadromous *O. mykiss* that historically occupied basins upstream of Hells Canyon (e.g., Powder, Burnt, Malheur, Owhyee rivers) may have been in a separate ESU. For many BRT members, the presence of relatively numerous resident fish mitigated the assessment of extinction risk for the ESU as a whole.

Upper Columbia River steelhead ESU

A slight majority (54%) of the BRT votes for this ESU fell in the “danger of extinction” category, with most of the rest falling in the “likely to become endangered” category (Table B.3.1). The most serious risk identified for this ESU was growth rate/productivity (mean score 4.3); scores for the other VSP factors were also relatively high, ranging from 3.1 (spatial structure) to 3.6 (diversity) (Table B.3.2). The last 2-3 years have seen an encouraging increase in the number of naturally produced fish in this ESU. However, the recent mean abundance in the major basins is still only a fraction of interim recovery targets (NMFS 2002). Furthermore, overall adult returns are still dominated by hatchery fish, and detailed information is lacking regarding productivity of natural populations. The ratio of naturally produced adults to the number of parental spawners (including hatchery fish) remains low for upper Columbia steelhead. The BRT did not find data to suggest that the extremely low replacement rate of naturally spawning fish (estimated adult: adult ratio was only 0.25-0.3 at the time of the last status review update) has improved substantially.

Based on the provisional framework discussed in the general Introduction to this report, the BRT assumed as a working hypothesis that resident fish below historical barriers are part of this ESU, while those above long-standing natural barriers (e.g., in the Entiat, Methow, and perhaps Okanogan basins) are not. Resident fish potentially occur in all areas in the ESU used by steelhead. Case 3 resident fish above Conconully Dam are of uncertain ESU affinity. The BRT did not attempt to resolve the ESU status of resident fish residing above Grand Coulee Dam, as little new information is available relevant to this issue. Possible ESU scenarios for these fish include 1) they were historically part of the ESU and many of the remnant resident populations still are part of this ESU; 2) they were historically part of the ESU but no longer are, due to either introductions of hatchery rainbow trout or rapid evolution in a novel environment; or 3) they were historically part of a separate ESU. For many BRT members, the presence of relatively numerous resident fish mitigated the assessment of extinction risk for the ESU as a whole.

Middle Columbia River steelhead ESU

A slight majority (51%) of the BRT votes for this ESU fell in the “likely to become endangered” category, with a substantial minority (49%) falling in the “not likely to become endangered” category (Table B.3.1). The BRT did not identify any extreme risks for this ESU but found moderate risks in all the VSP categories (mean risk matrix scores ranged from 2.5 for diversity to 2.7 for abundance) (Table B.3.2).

This ESU proved difficult to evaluate for two reasons. First, the status of different populations within the ESU varies greatly. On the one hand the abundance in two major basins, the Deschutes and John Day, is relatively high and over the last five years is close to or slightly

over the interim recovery targets (NMFS 2002). On the other hand, steelhead in the Yakima basin, once a large producer of steelhead, remain severely depressed (10% of the interim recovery target), in spite of increases in the last 2 years. Furthermore, in recent years escapement to spawning grounds in the Deschutes River has been dominated by stray, out-of-basin (and largely out-of-ESU) fish—which raises substantial questions about genetic integrity and productivity of the Deschutes population. The John Day is the only basin of substantial size in which production is clearly driven by natural spawners. For the other major basin in the ESU (the Klickitat), no quantitative abundance information is available. The other difficult issue centered on how to evaluate contribution of resident fish, which according to Kostow (2003) and other sources are very common in this ESU and may greatly outnumber anadromous fish. The BRT concluded that the relatively abundant and widely distributed resident fish mitigated extinction risk in this ESU somewhat. However, due to significant threats to the anadromous component the majority of BRT members concluded the ESU was likely to become endangered.

Historically, resident fish are believed to have occurred in all areas in the ESU used by steelhead, although current distribution is more restricted. Based on the provisional framework discussed in the general Introduction to this report, the BRT assumed as a working hypothesis that resident fish below historical barriers are part of this ESU, while those above long-standing natural barriers (e.g., in Deschutes and John Day basins) are not. Case 3 resident fish above Condit Dam in the Little White Salmon; above Pelton and Round Butte Dams (but below natural barriers) in the Deschutes; and above irrigation dams in the Umatilla Rivers are of uncertain ESU status.

Lower Columbia River steelhead ESU

A large majority (over 79%) of the BRT votes for this ESU fell in the “likely to become endangered” category, with small minorities falling in the “danger of extinction” and “not likely to become endangered” categories (Table B.3.1). The BRT found moderate risks in all the VSP categories, with mean risk matrix scores ranging from 2.7 for spatial structure to 3.3 for both abundance and growth rate/productivity) (Table B.3.2). All of the major risk factors identified by previous BRTs still remain. Most populations are at relatively low abundance, and those with adequate data for modeling are estimated to have a relatively high extinction probability. Some populations, particularly summer run, have shown higher returns in the last 2-3 years. The Willamette Lower Columbia River TRT (Myers et al. 2002) has estimated that at least four historical populations are now extinct. The hatchery contribution to natural spawning remains high in many populations.

Based on the provisional framework discussed in the general Introduction to this report, the BRT assumed as a working hypothesis that resident fish below historical barriers are part of this ESU, while those above long-standing natural barriers (e.g., in upper Clackamas, Sandy, and some of the small tributaries of the Columbia River Gorge) are not. Case 3 resident fish above dams on the Cowlitz, Lewis, and Sandy Rivers are of uncertain ESU status.

Upper Willamette River steelhead ESU

The majority (over 76%) of the BRT votes for this ESU fell in the “likely to become endangered” category, with small minorities falling in the “danger of extinction” and “not likely to become endangered” categories (Table B.3.1). The BRT did not identify any extreme risks for this ESU but found moderate risks in all the VSP categories (mean risk matrix scores ranged from 2.6 for diversity to 2.9 for both spatial structure and growth rate/productivity) (Table B.3.2). On a positive note, after a decade in which overall abundance (Willamette Falls count) hovered around the lowest levels on record, adult returns for 2001 and 2002 were up significantly, on par with levels seen in the 1980s. Still, the total abundance is small for an entire ESU, resulting in a number of populations that are each at relatively low abundance. The recent increases are encouraging but it is uncertain whether they can be sustained. The BRT considered it a positive sign that releases of the “early” winter-run hatchery population have been discontinued, but remained concerned that releases of non-native summer-run steelhead continue.

Because coastal cutthroat trout is a dominant species in the basin, resident *O. mykiss* are not as widespread here as in areas east of the Cascades. Resident fish below barriers are found in the Pudding/Molalla, Lower Santiam, Calapooia, and Tualatin drainages, and these would be considered part of the steelhead ESU based on the provisional framework discussed in the general Introduction. Resident fish above Big Cliff and Detroit Dams on the North Fork Santiam and above Green Peter Dam on the South Fork Santiam are of uncertain ESU affinity. Although no obvious physical barrier separates populations upstream of the Calapooia from those lower in the basin, resident *O. mykiss* in these upper reaches of the Willamette basin are quite distinctive both phenotypically and genetically and are not considered part of the steelhead ESU.

Northern California steelhead ESU

The majority (74%) of BRT votes were for “likely to become endangered,” with the remaining votes split about equally between “in danger of extinction” and “not warranted” (Table B.3.1). Abundance and productivity were of some concern (scores of 3.7; 3.3 in the risk matrix); spatial structure and diversity were of lower concern (scores of 2.2; 2.5); although at least one BRT member gave scores as high as 4 for each of these risk metrics (Table B.3.2).

The BRT considered the lack of data for this ESU to be a source of risk due to uncertainty. The lack of recent data is particularly acute for winter runs. While there are older data for several of the larger river systems that imply run sizes became much reduced since the early twentieth century, there are no recent data suggesting much of an improvement.

Based on the provisional framework discussed in the general Introduction to this report, the BRT assumed as a working hypothesis that resident fish below historical barriers are part of the Northern California Coast Steelhead ESU, while those above long-standing natural barriers are not. Historically, resident fish are believed to have occurred in all areas in the ESU used by steelhead, although current distribution is more restricted. Resident fish above recent (usually man-made) barriers--including Robert W. Matthews Dam on the Mad River and Scott Dam on the Eel River--but below natural barriers are of uncertain ESU affinity. In this ESU, the inclusion of resident fish would not greatly increase the total numbers of fish, and the resident fish have not been exposed to large amounts of hatchery stocking.

Central California Coast steelhead ESU

The majority (69%) of BRT votes were for “likely to become endangered,” and another 25% were for “in danger of extinction” (Table B.3.1). Abundance and productivity were of relatively high concern (mean score of 3.9 for each, with a range of 3 to 5 for each), and spatial structure was also of concern (score 3.6) (Table B.3.2). Predation by pinnipeds at river mouths and during the ocean phase was noted as a recent development posing significant risk.

There were no time-series data for this ESU. A variety of evidence suggested the largest run in the ESU (the Russian River winter steelhead run) has been reduced in size and continues to be reduced in size. Concern was also expressed about the populations in the southern part of the range of the ESU--notably populations in Santa Cruz County and the South Bay area.

Based on the provisional framework discussed in the general Introduction to this report, the BRT assumed as a working hypothesis that resident fish below historical barriers are part of the Central California Coast Steelhead ESU, while those above long-standing natural barriers are not. Historically, resident fish are believed to have occurred in all areas in the ESU used by steelhead, although current distribution is more restricted. Resident fish above recent (usually man-made) barriers--including Warm Springs Dam on Dry Creek, Russian River; Coyote Dam on the East Fork Russian River; Seeger Dam on Lagunitas Creek; Peters Dam on Nicasio Creek, Lagunitas Creek; and Standish Dam on Coyote Creek--but below natural barriers are of uncertain ESU affinity. In this ESU, an estimated 22% of historical habitat is behind recent barriers. The only relevant biological information about the populations above these barriers pertains to Alameda Creek, and suggests that some but not all populations above Dam 1 are genetically similar to populations within the ESU. For some BRT members, the presence of resident fish mitigated the assessment of extinction risk for the ESU as a whole.

South-Central California Coast steelhead ESU

The majority (68%) of BRT votes were for “likely to become endangered,” and another 25% were for “in danger of extinction” (Table B.3.1). The strongest concern was for spatial structure (score 3.9; range 3-5), but abundance and productivity were also a concern (Table B.3.2). The cessation of plants to the ESU from the Big Creek Hatchery (Central Coast ESU) was noted as a positive development, whereas continued predation from sport fishers was considered a negative development.

New data suggests that populations of steelhead exist in most of the streams within the geographic boundaries of the ESU; however, the BRT was concerned that the two largest river systems—the Pajaro and Salinas basins—are much degraded and have steelhead runs much reduced in size. Concern was also expressed about the fact that these two large systems are ecologically distinct from the populations in the Big Sur area and San Luis Obispo County, and thus their degradation affects spatial structure and diversity of the ESU. Much discussion centered on the dataset from the Carmel River, including the effects of the drought in the 1980s, the current dependence of the population on intensive management of the river system, and the vulnerability of the population to future droughts.

Based on the provisional framework discussed in the general Introduction to this report, the BRT assumed as a working hypothesis that resident fish below historical barriers are part of the South-Central California Coast Steelhead ESU, while those above long-standing natural barriers are not. Historically, resident fish are believed to have occurred in all areas in the ESU used by steelhead, although current distribution is more restricted. Resident fish above recent (usually man-made) barriers--including San Antonia, Nacimiento, and Salinas dams on the Salinas River; Los Padres Dam on the Carmel River; Whale Rock Dam on Old Creek; and Lopez Dam on Arroyo Grande Creek--but below natural barriers are of uncertain ESU affinity. In this ESU, little of the historical habitat is behind recent barriers and most of that on the Salinas River. For some BRT members, the presence of resident fish mitigated the assessment of extinction risk for the ESU as a whole.

Southern California steelhead ESU

The majority (81%) of BRT votes were for “in danger of extinction,” with the remaining 19% of votes being for “likely to become endangered” (Table B.3.1). Extremely strong concern was expressed for abundance, productivity, and spatial structure (mean scores of 4.8, 4.3, and 4.8, respectively, in the risk matrix), and diversity was also of concern (mean score of 3.6) (Table B.3.2).

The BRT expressed concern about the lack of data on this ESU, about uncertainty as to the metapopulation dynamics in the southern part of the range of the ESU, and about the fish’s nearly complete extirpation from the southern part of the range. Several members were concerned and uncertain about the relationship between the population in Sespe Canyon, which is supposedly a sizeable population, and the small run size passing through the Santa Clara River, which connects the Sespe to the ocean. There was some skepticism that flows in the Santa Maria River were sufficient to allow fish passage from the ocean to the Sisquoc River, another “stronghold” of *O. mykiss* in the ESU.

Based on the provisional framework discussed in the general Introduction to this report, the BRT assumed as a working hypothesis that resident fish below historical barriers are part of the South California Steelhead ESU, while those above long-standing natural barriers are not. Historically, resident fish are believed to have occurred in all areas in the ESU used by steelhead, although current distribution is more restricted. Resident fish above recent (usually man-made) barriers--including Twitchell Dam on the Cuyama River; Bradbury Dam on the Santa Ynez River; Casitas Dam on Coyote Creek, Ventura River; Matilija Dam on Matilija Creek, Ventura River; Santa Felicia Dam on Piru Creek, Santa Clara River; and Casitac Dam on Casitac Creek, Santa Clara River--but below natural barriers are of uncertain ESU affinity. In this ESU, a large portion of the original area is behind barriers, and the few density estimates that are available from this ESU indicate that the inclusion of area above recent barriers would substantially increase the number of fish in the ESU. Due to the extremely low numbers of anadromous fish in this ESU, it is possible that above-barrier populations contribute a significant number of fish to the below-barrier population by spill over. For some BRT members, the presence of resident fish mitigated the assessment of extinction risk for the ESU as a whole.

California Central Valley steelhead ESU

The majority (66%) of BRT votes were for “in danger of extinction”, and the remainder was for “likely to become endangered” (Table B.3.1). Abundance, productivity and spatial structure were of highest concern (4.2-4.4), although diversity considerations were of significant concern (3.6) (Table B.3.2). All categories received a 5 from at least one BRT member.

The BRT was highly concerned by the fact that what little new information was available indicated that the monotonic decline in total abundance and in the proportion of wild fish in the ESU was continuing. Other major concerns included the loss of the vast majority of historical spawning areas above impassable dams, the lack of any steelhead-specific status monitoring, and the significant production of out-of-ESU steelhead by the Nimbus and Mokelumne River fish hatcheries. The BRT viewed the anadromous life-history form as a critical component of diversity within the ESU and did not place much importance on sparse information suggesting widespread and abundant *O. mykiss* populations in areas above impassable dams. Dams both reduce the scope for expression of the anadromous life-history form, thereby greatly reducing the abundance of anadromous *O. mykiss*, and prevent exchange of migrants among resident populations, a process presumably mediated by anadromous fish.

Based on the provisional framework discussed in the general Introduction to this report, the BRT assumed as a working hypothesis that resident fish below historical barriers are part of the California Central Valley Steelhead ESU, while those above long-standing natural barriers are not. Historically, resident fish are believed to have occurred in all areas in the ESU used by steelhead, although current distribution is more restricted. Resident fish above recent (usually man-made) barriers--including Shasta Dam on the Upper Sacramento River; Whiskeytown Dam on Clear Creek; Black Butte Dam on Stony Creek; Oroville Dam on the Feather River; Englebright Dam on the Yuba River; Camp Far West Dam on the Bear River; Nimbus Dam on the American River; Commanche Dam on the Mokelumne River; New Hogan Dam on the Calaveras River; Goodwin Dam on the Stanislaus River; La Grange Dam on the Tuolumne River; and Crocker Diversion Dam on the Merced River--but below natural barriers are of uncertain ESU affinity. As noted above, collectively these dams have isolated a large fraction of historical steelhead habitat, and resident fish above the dams may outnumber ESU fish from below the dams.

Table B.3.1. Tally of FEMAT vote distribution regarding the status of 10 steelhead ESUs reviewed. Each of 16 BRT members allocated 10 points among the three status categories.

ESU	Danger of Extinction	Likely to Become Endangered	Not Likely to Become Endangered
Snake River ¹	14	103	23
Upper Columbia ¹	75	62	3
Middle Columbia ¹	1	71	68
Lower Columbia ²	10	110	30
Upper Willamette ²	7	106	37
Northern California	18	119	23
Central California Coast	40	111	9
South Central California	40	109	11
Southern California	129	31	0
Central Valley	106	54	0

¹ Votes tallied for 14 BRT members

² Votes tallied for 15 BRT members

Table B.3.2. Summary of risk scores (1 = low to 5 = high) for four VSP categories (see section "Factors Considered in Status Assessments" for a description of the risk categories) for the 10 steelhead ESUs reviewed. Data presented are means (range).

ESU	Abundance	Growth Rate/Productivity	Spatial Structure and Connectivity	Diversity
Snake River	3.1 (2-4)	3.2 (2-4)	2.5 (1-4)	3.1 (2-4)
Upper Columbia	3.5 (2-4)	4.3 (3-5)	3.1 (2-4)	3.6 (2-5)
Middle Columbia	2.7 (2-4)	2.6 (2-3)	2.6 (2-4)	2.5 (2-4)
Lower Columbia	3.3 (2-5)	3.3 (3-4)	2.7 (2-4)	3.0 (2-4)
Upper Willamette	2.8 (2-4)	2.9 (2-4)	2.9 (2-4)	2.6 (2-3)
Northern California	3.7 (3-5)	3.3 (2-4)	2.2 (1-4)	2.5 (1-4)
Central California Coast	3.9 (3-5)	3.9 (3-5)	3.6 (2-5)	2.8 (2-4)
South Central California	3.7 (2-5)	3.3 (2-4)	3.9 (3-5)	2.9 (2-4)
Southern California	4.8 (4-5)	4.3 (3-5)	4.8 (4-5)	3.6 (2-5)
Central Valley	4.4 (4-5)	4.3 (4-3)	4.2 (2-5)	3.6 (2-5)

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